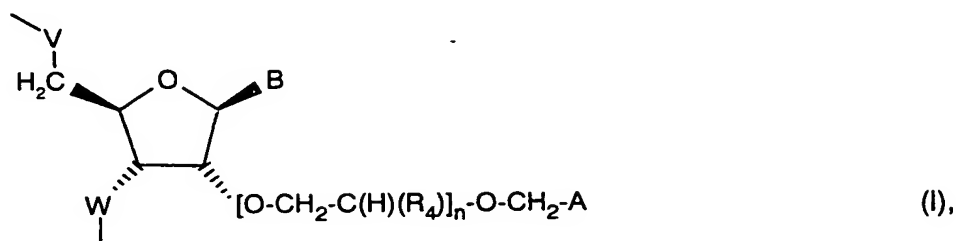


WHAT IS CLAIMED IS:

1. An oligonucleotide derivative comprising at least one nucleoside building block of the formula (I)



in which

A is a radical of the formula $-C(H)(R_3)-N(R_1)(R_2)$, in which

R_1 and R_2 are, independently of each other

H,

C_1 - C_{10} alkyl,

a radical of the formula II



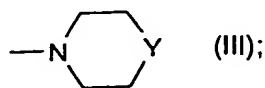
in which each X is, in each case independently of each other, O or $N(R_6)$, R_5 and R_6 are, in each case independently of each other, H, C_1 - C_{10} alkyl, amino- C_2 - C_{10} alkyl, N-mono- C_1 - C_{10} alkylamino- C_2 - C_{10} alkyl or N,N-di- C_1 - C_{10} alkylamino- C_2 - C_{10} alkyl, and m is an integer from 1 up to and including 3,

amino- C_3 - C_{10} alkyl,

N-mono- C_1 - C_{10} alkylamino- C_3 - C_{10} alkyl, or

N,N-di- C_1 - C_{10} alkylamino- C_3 - C_{10} alkyl; or in which

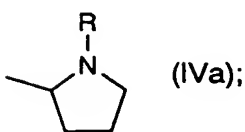
$-N(R_1)(R_2)$ are together a radical of the formula (III),



in which Y is O, S, SO, SO_2 or $N(R_7)$, and R_7 is H or $-CH_3$;

R_3 is H, $-CH_3$, $-CH_2CH_3$, $-CH_2OH$ or $-CH_2-O-C_1-C_4$ alkyl; or

A is a radical of the formula (IVa) or (IVb)



in which R, independently, has the meaning of R₁ or R₂, and U is O or CH₂;

R₄ is H, -CH₃, -CH₂CH₃, -CH₂OH or -CH₂-O-C₁-C₄alkyl;

n is 0, 1 or 2;

B is the radical of a nucleic acid base; and

V and W are, independently of each other, the same or different radicals of an internucleosidic bridging group or are a terminal radical;

and a salt thereof;

where those compounds are excepted in which, in the radical A, two heteroatoms are linked to the same carbon atom.

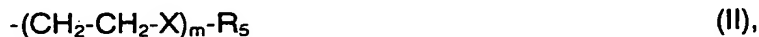
2. An oligonucleotide derivative according to claim 1, in which

A is a radical of the formula -C(H)(R₃)-N(R₁)(R₂), in which

R₁ and R₂ are, independently of each other, H, C₁-C₅alkyl, amino-C₂-C₅alkyl, N-mono-

C₁-C₃alkylamino-C₂-C₅alkyl, N,N-di-C₁-C₃alkylamino-C₂-C₅alkyl or a radical of the formula

II



in which X is O or N(R₆), R₅ and R₆ are, independently of each other, H, C₁-C₃alkyl, amino-C₂-C₃alkyl, N-mono-C₁-C₃alkylamino-C₂-C₅alkyl or N,N-di-C₁-C₃alkylamino-C₂-C₅-alkyl, and m is 1.

3. An oligonucleotide derivative according to claim 2, in which

R₁ and R₂ are, independently of each other, H, methyl, ethyl, aminoethyl, aminopropyl, N-monomethylaminoethyl, N-monomethylaminopropyl, N-monoethylaminoethyl,

N-monoethylaminopropyl, N,N-dimethylaminoethyl, N,N-dimethylaminopropyl, N,N-diethylaminoethyl, N,N-diethylaminopropyl, or a radical of the formula II



in which X is O or N(R₆), R₅ and R₆ are, independently of each other, H, methyl, ethyl or propyl, and m is 1.

4. An oligonucleotide derivative according to claim 3, in which R₁ and R₂ are, independently of each other, H, methyl, ethyl, aminoethyl, N-monomethylaminoethyl, N-monoethylaminoethyl, N,N-dimethylaminoethyl or N,N-diethylaminoethyl.

5. An oligonucleotide derivative according to claim 4, in which R₁ and R₂ are, independently of each other, H, methyl or ethyl.

6. An oligonucleotide derivative according to claim 5, in which R₁ and R₂ are in each case H, or R₁ and R₂ are in each case methyl, or one of the substituents R₁ and R₂ is H and the other is methyl.

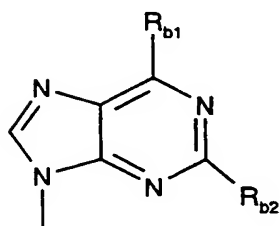
7. An oligonucleotide derivative according to claim 5, in which R₁ and R₂ are in each case methyl, or one of the substituents R₁ and R₂ is H and the other is methyl.

8. An oligonucleotide derivative according to claim 1, in which R₃ and R₄ are, independently of each other, H, -CH₃, -CH₂OH or -CH₂-O-CH₃.

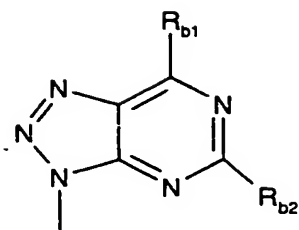
9. An oligonucleotide derivate according to claim 1, in which n is 0.

10. An oligonucleotide derivative according to claim 9, in which A is a radical of the formula -C(H)(R₃)-N(R₁)(R₂), in which R₃ is H, and R₁ and R₂ are defined as in claim 1.

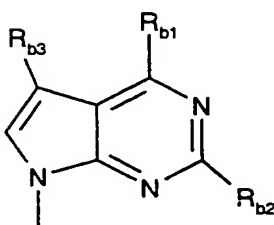
11. An oligonucleotide derivative according to claim 1, in which B is a radical of the formula (V1) to (V14)



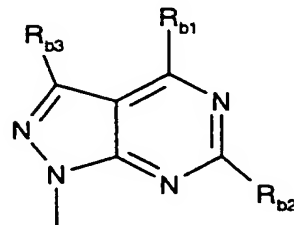
(V1),



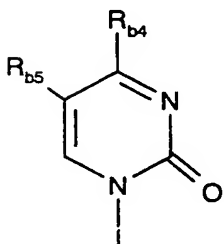
(V2),



(V3),



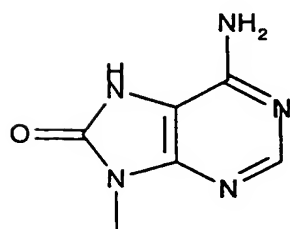
(V4),



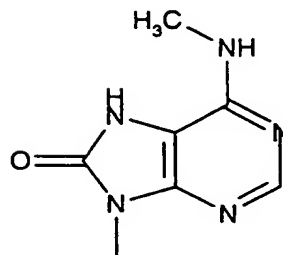
(V5),



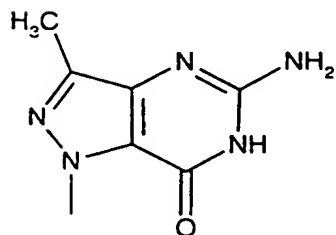
(V6),



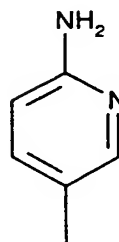
(V7),



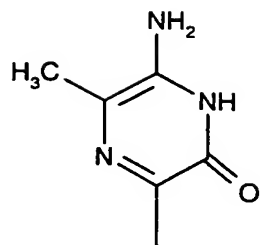
(V8),



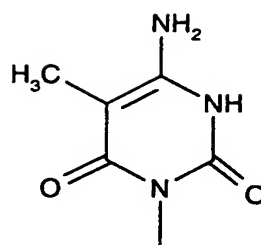
(V9),



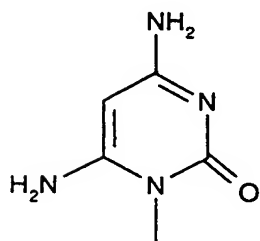
(V10),



(V11),



(V12),



(V13),



(V14)

in which

R_{b1} is $-NH_2$, $-SH$ or $-OH$;

R_{b2} is H , $-NH_2$ or $-OH$; and

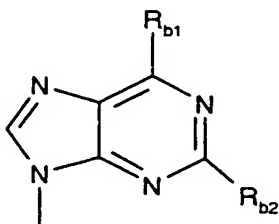
R_{b3} is H , Br , I , $-CN$, $-C\equiv C-CH_3$, $-C(O)NH_2$ or $-CH_3$;

R_{b4} is $-NH_2$ or $-OH$; and

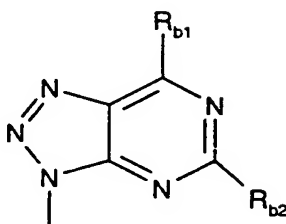
R_{b5} is H , F , Br , I , $-CN$, $-C\equiv C-CH_3$, $-C(O)NH_2$ or $-CH_3$.

12. An oligonucleotide derivative according to claim 11, in which

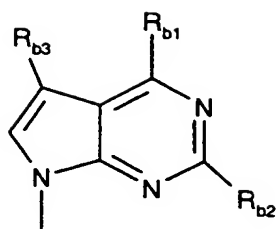
B is a radical of the formula (V1), (V2), (V3), (V4) or (V5)



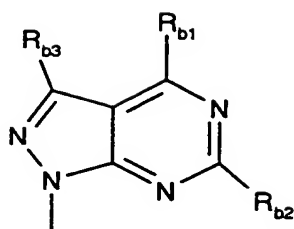
(V1),



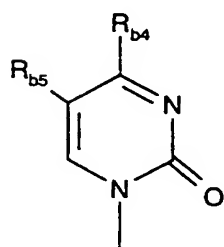
(V2),



(V3),



(V4),



(V5)

in which

R_{b1} is $-NH_2$, $-SH$ or $-OH$;

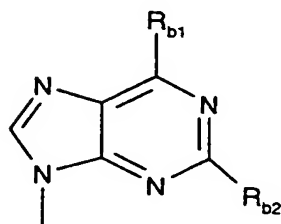
R_{b2} is H , $-NH_2$ or $-OH$; and

R_{b3} is H , Br , I , $-CN$, $-C\equiv C-CH_3$, $-C(O)NH_2$ or $-CH_3$;

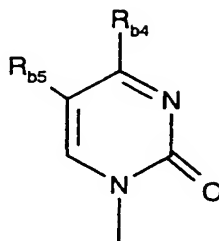
R_{b4} is $-NH_2$ or $-OH$; and

R_{b5} is H , F , Br , I , $-CN$, $-C\equiv C-CH_3$, $-C(O)NH_2$ or $-CH_3$.

13. An oligonucleotide derivative according to claim 12, in which B is a radical of the formula (V1) or (V5)



(V1),



(V5)

in which

R_{b1} is $-NH_2$, $-SH$ or $-OH$;

R_{b2} is H , $-NH_2$ or $-OH$;

R_{b4} is -NH₂ or -OH; and

R_{b5} is H, F, Br, I, -CN, -C≡C-CH₃, -C(O)NH₂ or -CH₃.

14. An oligonucleotide derivative according to claim 13, in which B is selected from the group of the following radicals: xanthine, hypoxanthine, adenine, 2-aminoadenine, guanine, 6-thioguanine, uracil, thymine, cytosine, 5-methylcytosine, 5-propynyluracil, 5-fluorouracil and 5-propynylcytosine.

15. An oligonucleotide derivative according to claim 1, in which

V and W, as radicals of an internucleosidic bridging group, are, independently of each other, selected from the following group: 5'-O-P(O)(OH)-O-3' (phosphodiester), 5'-O-P(O)(SH)-O-3' (phosphorothioate), 5'-O-P(S)(SH)-O-3' (phosphodithioate), 5'-O-P(O)(CH₃)-O-3' (methylphosphonate), 5'-O-P(O)(NH-R₇)-O-3' (phosphoamidate) in which R₇ is C₁-C₃alkyl, 5'-O-P(O)(OR₈)-O-3' (phosphotriester) in which R₈ is C₁-C₃alkyl, 5'-O-S(O)₂-CH₂-3' (sulfonate), 5'-O-S(O)₂-NH-3' (sulfamate), 5'-NH-S(O)₂-CH₂-3' (sulfonamide), 5'-CH₂-S(O)₂-CH₂-3' (sulfone), 5'-O-S(O)-O-3' (sulfite), 5'-CH₂-S(O)-CH₂-3' (sulfoxide), 5'-CH₂-S-CH₂-3' (sulfide), 5'-O-CH₂-O-3' (formacetal), 5'-S-CH₂-O-3' (3'-thioformacetal), 5'-O-CH₂-S-3' (5'-thioformacetal), 5'-CH₂-CH₂-S-3' (thioether), 5'-CH₂-NH-O-3' (hydroxylamine), 5'-CH₂-N(CH₃)-O-3' (methylene(methylimino)), 5'-CH₂-O-N(CH₃)-3' (methyleneoxy(methylimino)), 5'-O-C(O)-NH-3' (5'-N-carbamate), 5'-CH₂-C(O)-NH-3' (amide), 5'-NH-C(O)-CH₂-3' (amide II), 5'-CH₂-NH-C(O)-3' (amide III) and 5'-C(O)-NH-CH₂-3' (amide IV), and the tautomeric forms thereof.

16. An oligonucleotide derivative according to claim 15, in which

V and W, as radicals of an internucleosidic bridging group, are, independently of each other, selected from the following group: 5'-O-P(O)(OH)-O-3' (phosphodiester), 5'-O-P(O)(SH)-O-3' (phosphorothioate) and 5'-CH₂-C(O)-NH-3' (amide).

17. An oligonucleotide derivative according to claim 16, in which

one of the radicals V or W, as radicals of an internucleosidic bridging group, is 5'-O-P(O)(OH)-O-3' (phosphodiester) and the other radical is 5'-O-P(O)(SH)-O-3' (phosphorothioate).

18. An oligonucleotide derivate according to claim 16, in which

V and W as radicals of an internucleosidic bridging group, are in each case 5'-O-P(O)(OH)-O-3' (phosphodiester) or in each case 5'-O-P(O)(SH)-O-3' (phosphorothioate).

19. An oligonucleotide derivative according to claim 1, in which

V and W, as terminal radicals, are, independently of each other, -OH, -NH₂ or a hydroxyl or amino group which is protected by a protecting group.

20. An oligonucleotide derivative according to claim 17, in which

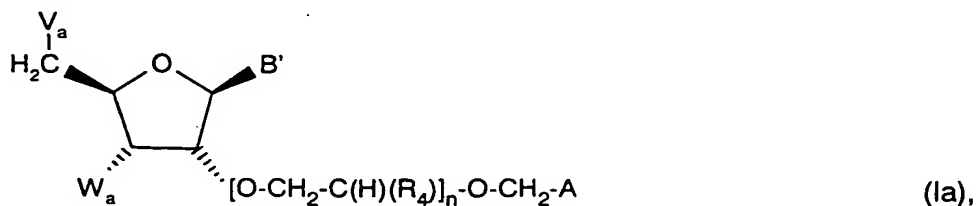
V, as terminal radical, is -OH, -NH₂ or a protected hydroxyl or amino group, and, W is -OH or -NH₂.

21. An oligonucleotide derivative according to claim 1, which has a length of from 3 to 50 nucleoside building blocks.

22. An oligonucleotide derivative according to claim 18, which has a length of from 10 to 25 nucleoside building blocks.

23. An oligonucleotide derivative according to claim 1, wherein the oligonucleotide derivative has a chimeric structure.

24. A compound of the formula (Ia)



in which

A is a radical of the formula -C(H)(R₃)-N(R₁)(R₂), in which

R₁ and R₂ are, independently of each other,

H,

C₁-C₁₀alkyl,

a radical of the formula II



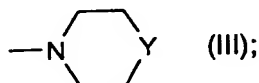
in which each X is, in each case, independently of each other, O or N(R₆), R₅ and R₆ are, in each case, independently of each other, H, C₁-C₁₀alkyl, amino-C₂-C₁₀alkyl, N-mono-C₁-C₁₀alkylamino-C₂-C₁₀alkyl or N,N-di-C₁-C₁₀alkylamino-C₂-C₁₀alkyl, and m is an integer from 1 up to and including 3,

amino-C₃-C₁₀alkyl,

N-mono-C₁-C₁₀alkylamino-C₃-C₁₀alkyl, or

N,N-di-C₁-C₁₀alkylamino-C₃-C₁₀alkyl; or in which

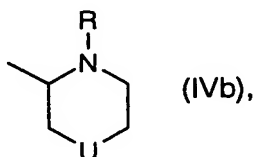
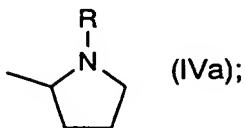
-N(R₁)(R₂) are together a radical of the formula (III)



in which Y is O, S, SO, SO₂ or N(R₇), and R₇ is H or -CH₃;

R₃ is H, -CH₃, -CH₂CH₃, -CH₂OH or -CH₂-O-C₁-C₄alkyl; or

A is a radical of the formula (IVa) or (IVb)



in which R, independently, has the meaning of R₁ or R₂, and U is O or CH₂;

R₄ is H, -CH₃, -CH₂CH₃, -CH₂OH or -CH₂-O-C₁-C₄alkyl;

n is 0, 1 or 2;

B' is the radical of a protected or unprotected nucleic acid base; and

V_a and W_a are, independently of each other, -OH, -NH₂ or identically or differently protected hydroxyl or amino groups,

where those compounds are excepted in which, in the radical A, two heteroatoms are linked to the same carbon atom,

and where other reactive groups are present in the protected or unprotected state.

25. A compound according to claim 24, in which

A is a radical of the formula $-\text{C}(\text{H})(\text{R}_3)-\text{N}(\text{R}_1)(\text{R}_2)$, in which

R_1 and R_2 are, independently of each other, H, C_1 - C_5 alkyl, amino- C_2 - C_5 alkyl, N-Mono- C_1 - C_3 alkylamino- C_2 - C_5 alkyl, N,N-di- C_1 - C_3 alkylamino- C_2 - C_5 alkyl or a radical of the formula II



in which X is O or N(R_6), R_5 and R_6 are, independently of each other, H, C_1 - C_3 alkyl, amino- C_2 - C_3 alkyl, N-mono- C_1 - C_3 alkylamino- C_2 - C_5 alkyl or N,N-di- C_1 - C_3 alkylamino- C_2 - C_5 alkyl, and m is 1.

26. A compound according to claim 25, in which

R_1 and R_2 are, independently of each other, H, methyl, ethyl, aminoethyl, aminopropyl, N-monomethylaminoethyl, N-monomethylaminopropyl, N-monoethylaminoethyl, N-monoethylaminopropyl, N,N-dimethylaminoethyl, N,N-dimethylaminopropyl, N,N-diethylaminoethyl, N,N-diethylaminopropyl, or a radical of the formula II



in which X is O or N(R_6), R_5 and R_6 are, independently of each other, H, methyl, ethyl or propyl and m is 1.

27. A compound according to claim 26, in which

R_1 and R_2 are, independently of each other, H, methyl, ethyl, aminoethyl, N-monomethylaminoethyl, N-monoethylaminoethyl, N,N-dimethylaminoethyl or N,N-diethylaminoethyl.

28. A compound according to claim 27, in which

R_1 and R_2 are, independently of each other, H, methyl or ethyl.

29. A compound according to claim 28, in which
 R_1 and R_2 are in each case H, or
 R_1 and R_2 are in each case methyl, or
one of the substituents R_1 and R_2 is H and the other is methyl.

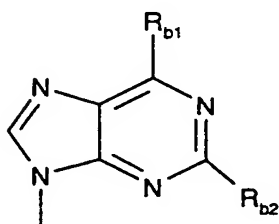
30. A compound according to claim 29, in which
 R_1 and R_2 are in each case methyl, or
one of the substituents R_1 and R_2 is H and the other is methyl.

31. A compound according to claim 24, in which
 R_3 and R_4 are, independently of each other, H, $-\text{CH}_3$, $-\text{CH}_2\text{OH}$ or $-\text{CH}_2\text{-O-CH}_3$.

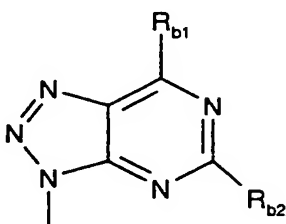
32. A compound according to claim 24, in which n is 0.

33. A compound according to claim 32, in which
A is a radical of the formula $-\text{C}(\text{H})(\text{R}_3)\text{-N}(\text{R}_1)(\text{R}_2)$, in which
 R_3 is H, and R_1 and R_2 are defined as in claim 24.

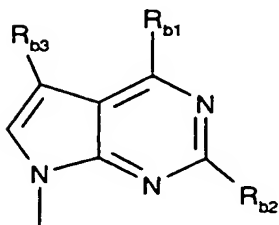
34. A compound according to claim 24, in which
B' is a radical of the formula (V1) to (V4)



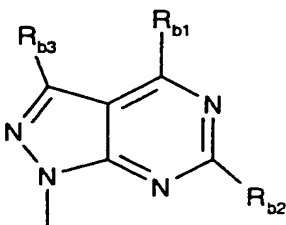
(V1),



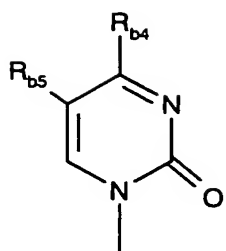
(V2),



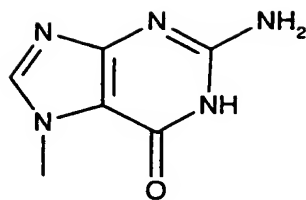
(V3),



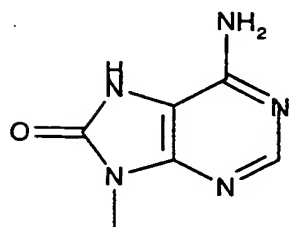
(V4),



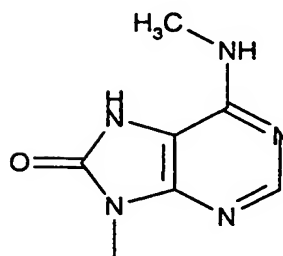
(V5),



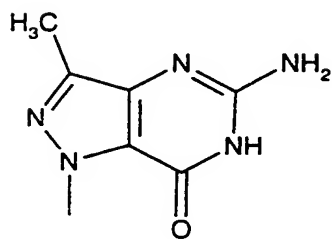
(V6),



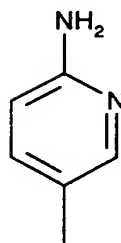
(V7),



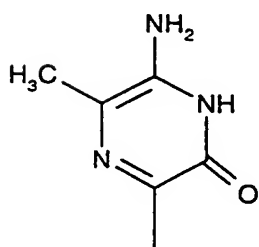
(V8),



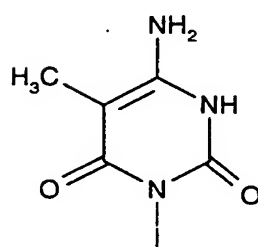
(V9),



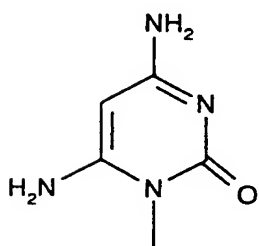
(V10),



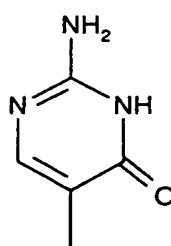
(V11),



(V12),



(V13),



(V14)

in which

R_{b1} is $-NH_2$, $-SH$ or $-OH$;

R_{b2} is H, $-NH_2$ or $-OH$; and

R_{b3} is H, Br, I, $-CN$, $-C\equiv C-CH_3$, $-C(O)NH_2$ or $-CH_3$;

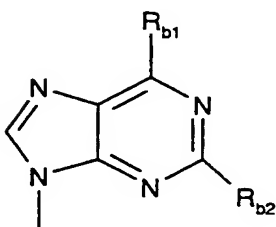
R_{b4} is $-NH_2$ or $-OH$; and

R_{b5} is H, F, Br, I, $-CN$, $-C\equiv C-CH_3$, $-C(O)NH_2$ or $-CH_3$,

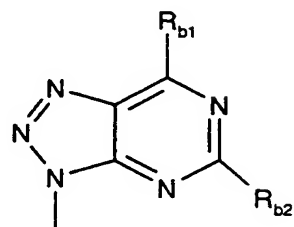
with exocyclic amino groups being present in unprotected or protected form.

35. A compound according to claim 34, in which

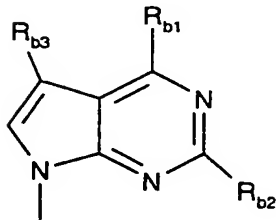
B' is a radical of the formula (V1), (V2), (V3), (V4) or (V5)



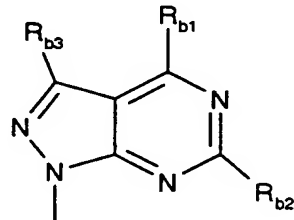
(V1),



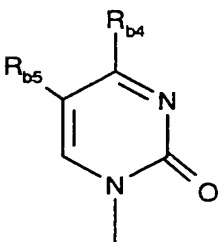
(V2),



(V3),



(V4),



(V5)

in which

R_{b1} is $-NH_2$, $-SH$ or $-OH$;

R_{b2} is H, $-NH_2$ or $-OH$; and

R_{b3} is H, Br, I, $-CN$, $-C\equiv C-CH_3$, $-C(O)NH_2$ or $-CH_3$;

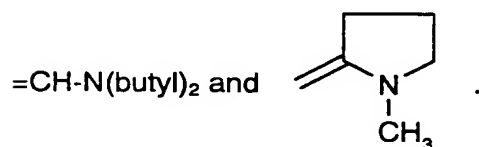
R_{b4} is $-NH_2$ or $-OH$; and

R_{b5} is H, F, Br, I, -CN, $-C\equiv C-CH_3$, $-C(O)NH_2$ or $-CH_3$,

with exocyclic amino groups being present in unprotected or protected form.

36. A compound according to claim 35, in which B' is selected from the group of the following radicals: xanthine, hypoxanthine, adenine, 2-aminoadenine, guanine, 6-thioguanine, uracil, thymine, cytosine, 5-methylcytosine, 5-propynyluracil, 5-fluorouracil and 5-propynylcytosine, with exocyclic amino groups being present in protected or unprotected form.

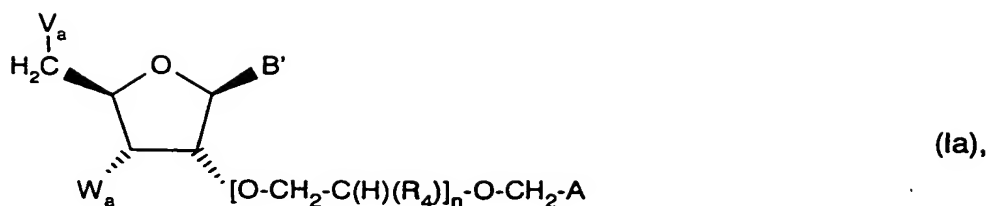
37. A compound according to claim 24, in which the protecting group for exocyclic amino groups of the nucleic acid base B' is selected from the following group: $-C(O)CH_3$, $-C(O)-CH(CH_3)_2$, $-C(O)-phenyl$, $-C(O)-CH_2-O-phenyl$, $-C(O)-CH-p-(tert-butyl)phenyl$, $-C(O)-CH_2-O-p-(tert-butyl)phenyl$, $-C(O)-CH_2-O-p-(isopropyl)phenyl$, $=CH-N(CH_3)_2$,



38. A compound according to claim 24, in which the protecting group for V_a or W_a , as a protected hydroxyl or amino group, is a trityl-type protecting group.

39. A compound according to claim 38, wherein the trityl-type protecting group is selected from the following group: trityl, 4-monomethoxytrityl, 4,4'-dimethoxytrityl and 4,4',4''-tris-tert-butyltrityl.

40. A process for preparing a compound of the formula (Ia) according to claim 24



in which V_a , W_a , A and B' are defined as in claim 24, and

(a) R_4 is H, $-CH_3$, $-CH_2CH_3$, $-CH_2OH$ or $-CH_2-O-C_1-C_4$ alkyl, and n is 0, which comprises reacting a compound of the formula (A)

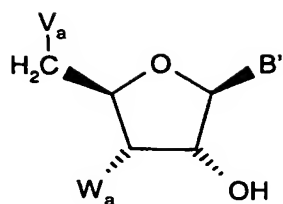


in which V_a and W_a are, independently of each other, a protected hydroxyl or amino group, and B' is defined as above, with exocyclic amino groups in B' being protected by protecting groups, with a compound of the formula (B)



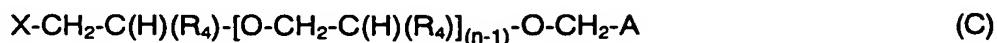
in which X is Cl, Br, I, tosyl-O or mesyl-O, and A is defined as above, with primary and secondary amino groups and primary hydroxyl groups in A being protected by protecting groups; or

(b) R_4 is H, $-CH_3$, $-CH_2CH_3$, $-CH_2OH$ or $-CH_2-O-C_1-C_4$ alkyl and n is 1 or 2, which comprises reacting a compound of the formula (A)



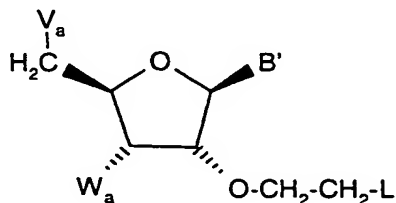
(A)

in which V_a and W_a are, independently of each other, a protected hydroxyl or amino group, and B is defined as above, with exocyclic amino groups in B' being protected by the protecting groups,
with a compound of the formula (C)



in which X is Cl, Br, I, tosyl-O or mesyl-O, and R_4 and A are defined as above, with primary and secondary amino groups and primary hydroxyl groups in A being protected by protecting groups; or

(c) R_4 is H and n is 1 or 2,
which comprises reacting a compound of the formula (D)



(D),

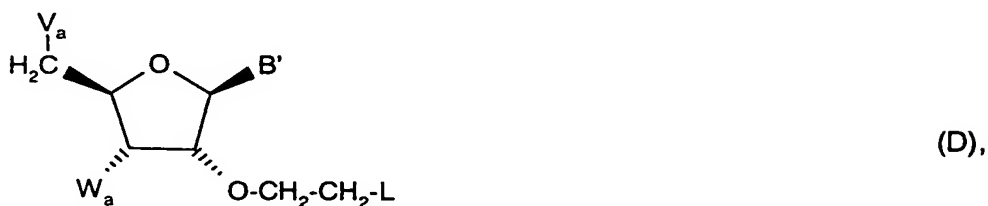
in which V_a and W_a are, independently of each other, a protected hydroxyl or amino group, B' is defined as above, with exocyclic amino groups in B' being protected by protecting groups, and L is a leaving group,

with a compound of the formula (E)



in which A is defined as above, and with primary and secondary amino groups and primary hydroxyl groups in A being protected by protecting groups; or

(d) R_4 is H, n is 0, and A is a radical of the formula $-\text{C}(\text{H})(\text{R}_3)-\text{N}(\text{R}_1)(\text{R}_2)$, which comprises reacting a compound of the formula (D)

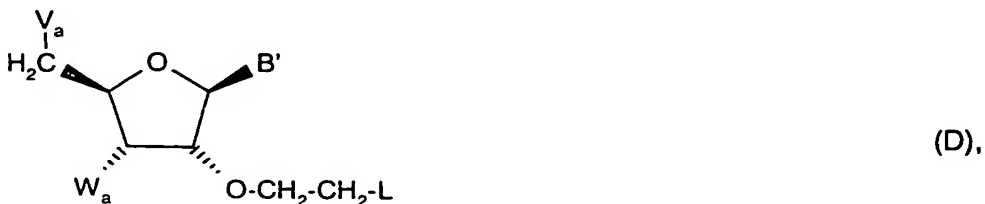


which is defined as above,
with a compound of the formula (F)



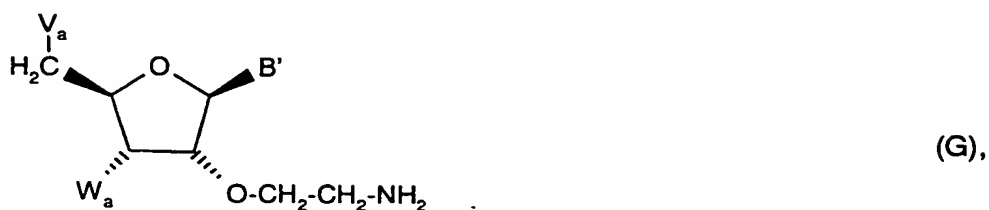
in which R_1 , R_2 or the group $-\text{N}(\text{R}_1)(\text{R}_2)$ are defined as in Claim 24, and with functional groups in R_1 or R_2 being protected if necessary; or

(e) R_4 is H, n is 0 and A is a radical of the formula $-\text{C}(\text{H})(\text{R}_3)-\text{N}(\text{R}_1)(\text{R}_2)$, which comprises reacting a compound of the formula (D)



which is defined as above,

with an azide and subsequent reduction, if necessary using a catalyst, to give a compound of the formula (G)



and, if necessary, subjecting the compound of the formula (G) to further derivatization; with in cases (a) to (e), protected groups subsequently being deprotected if necessary.

41. A process for preparing an oligonucleotide derivative according to claim 1, which comprises the following steps:

- (i) converting a compound of the formula (Ia) according to claim 24 into a form suitable for oligonucleotide synthesis,
- (ii) using the compound of the formula Ia according to claim 24, which compound is in a suitable form, in the oligonucleotide synthesis.

42. A use of a compound of the formula (Ia) according to claim 24 as a nucleoside building block, if desired after converting it into a suitable form for oligonucleotide synthesis, in the oligonucleotide synthesis.

43. A use of an oligonucleotide derivative according to claim 1 as an antisense oligonucleotide.

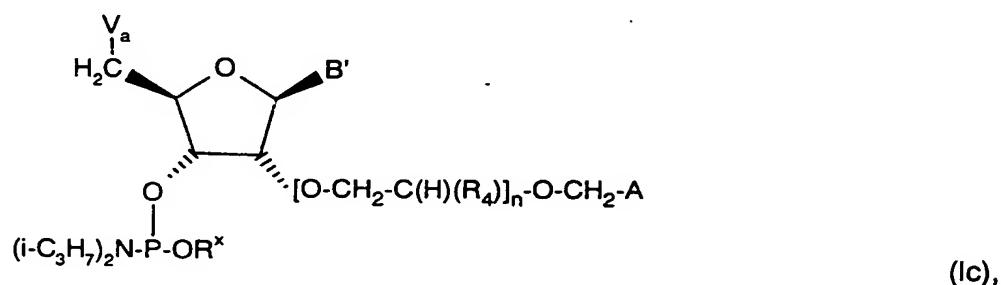
44. A use, according to claim 43, of an oligonucleotide derivative which is defined in claim 12.

45. A use of an oligonucleotide derivative according to claim 1 as a triplex-forming oligonucleotide.

46. A use, according to claim 45, of an oligonucleotide derivative which is defined in claim 11.
47. A use according to claim 45 of an oligonucleotide derivative which is defined in claim 12.
48. A pharmaceutical composition, which comprises an oligonucleotide derivative according to claim 1, or a pharmaceutically tolerated salt thereof, in a pharmaceutically effective quantity, if desired together with a pharmaceutically tolerated excipient and/or auxiliary substance.
49. A pharmaceutical composition according to claim 48, which additionally comprises a customary cytostatic agent.
50. An oligonucleotide derivative according to claim 1, or a pharmaceutically tolerated salt thereof, for use in the therapeutic treatment of a mammalian subject, including man.
51. A use of an oligonucleotide derivative according to claim 1, or of a pharmaceutically tolerated salt thereof, for preparing a pharmaceutical composition for the therapeutic treatment of a pathological state, in a mammalian subject including man, which is characterized by the expression of a protein or an RNA molecule.
52. A process for the therapeutic treatment of a pathological state, in a mammalian subject including man, which is characterized by the expression of a protein or an RNA molecule, which comprises administering a pharmaceutical composition according to claim 48 to the mammalian subject.
53. A process for modulating the expression of a protein or an RNA molecule in a cell, which comprises bringing the cell, or a tissue or body fluid containing this cell, into contact with an oligonucleotide derivative according to claim 1 or a pharmaceutical composition according to claim 48.
54. An oligonucleotide derivative according to claim 1 for use in a diagnostic method.

55. A compound of the formula (Ia) according to claim 24 for use in the therapeutic treatment of a mammalian subject, including man.

56. A compound of the formula (Ic)



in which V_a , R_4 , A and B' are defined as in claim 24, and R^x is a protecting group.

57. An oligonucleotide derivative according to claim 1, wherein the oligonucleotide derivative is essentially complementary to the region which extends from base position 2484 to base position 2503 of human c-raf mRNA.

58. An oligonucleotide derivative according to claim 57, wherein the oligonucleotide derivative possesses a base sequence according to SEQ.ID.NO.2 or a base sequence which is analogous thereto.